

Paragraph 3 of the Official Action reject claims 19, 20, 23-30, 47, 48 and 51-58 as obvious based on the combination of JP 07-038113 to Morosawa and U.S. Patent No. 5,648,276 to Hara. Paragraphs 4-6 of the Official Action reject claims 1-17, 21, 22, 49, 50 and 59-64 as obvious based on the combination of Morosawa, Hara and one or both of U.S. Patent No. 5,608,232 to Yamazaki and JP 09-186336 to Kudo. The Applicant respectfully traverses the rejection because the Official Action has not made a *prima facie* case of obviousness.

As stated in MPEP §§ 2142-2143.01, to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art. "The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art." In re Kotzab, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000). See also In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); In re Jones, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

The prior art, either alone or in combination, does not teach or suggest all the features of the independent claims.

Independent claims 19, 20, 47 and 48 recite irradiating a semiconductor film with laser light in an atmosphere containing oxygen for crystallizing the semiconductor film. The Official Action asserts that "Morosawa discloses ... irradiating said semiconductor

film with laser light in an atmosphere containing oxygen for crystallizing said semiconductor film" (pages 3, 5, 9 and 10, Paper No. 20060621). The Applicant respectfully disagrees and traverses the assertions in the Official Action. Morosawa discloses that "[t]he condition of irradiation is set at the substrate temperature from 200 to 400 °C and in a vacuum" (paragraph [0009] of the English translation, submitted April 18, 2005). The vacuum of Morosawa does not correspond with an atmosphere containing oxygen as recited in claims 19, 20, 47 and 48. Therefore, Morosawa does not teach or suggest irradiating a semiconductor film with laser light in an atmosphere containing oxygen for crystallizing the semiconductor film.

Hara does not cure the deficiencies in Morosawa. Hara is relied upon to allegedly teach "recrystallizing the semiconductor film in order to level the semiconductor film after native oxide removal process" (pages 3-4, 6, 10 and 11). Morosawa and Hara, either alone or in combination, do not teach or suggest irradiating a semiconductor film with laser light in an atmosphere containing oxygen for crystallizing the semiconductor film.

Independent claims 1-12, 19, 20, 47 and 48 recite removing a natural oxidation or oxide film formed on a surface of a crystallized semiconductor film by etching after irradiation of a laser light; and leveling a surface of the crystallized semiconductor film by recrystallizing the crystallized semiconductor film after removing the natural oxidation or oxide film.

In the "Response to Arguments" section, the Official Action asserts "that the prior art of record in combination disclose all the claimed [limitations] including 'removing a natural oxidation film formed on a surface of a crystallized semiconductor film by etching after irradiation of a laser light and leveling a surface of the crystallized semiconductor film after removing the natural oxidation' " (page 48, Paper No. 20060621). The Applicant respectfully disagrees and traverses the assertions in the Official Action.

The Official Action concedes that "Morosawa does not specifically disclose recrystallizing the crystallized semiconductor film in order to level the semiconductor film

after native oxide removal process” (pages 3, 5, 9, 10, etc., Id.). The Official Action asserts that Hara discloses “cleaning the semiconductor layer and recrystallizing the semiconductor layer (see Col. 1, line 65 – Col. 2, line 49) in order to level the surface of the semiconductor layer having good uniformity and high reliability (see Hara et al. Figs. 5A-22 and Col. 1, line 65 – Col. 16, line 67)” (Id.). The Applicant respectfully disagrees and traverses the assertions in the Official Action.

The alleged motivation, “having good uniformity and high reliability,” does not relate to recrystallizing a semiconductor layer in order to level a surface of a semiconductor layer. Rather, Hara appears to teach that “the method and apparatus can fabricate thin film semiconductor devices having a high performance and a high reliability with a good uniformity by making a clean and high quality semiconductor/insulator interface or by hydrogenating a semiconductor thin film without changes in electrical conductivity” (Abstract; emphasis added).

Further, as a reason for combining Morosawa and Hara, in the “Response to Arguments” section, the Official Action asserts that “during the HF treatment, the silicon film crystal structure [in Morosawa] will be damaged and ... Hara’s melting recrystallization step helps improve film quality of the silicon layer” and that “[t]he motivation directly can be found in the Hara et al. reference because such process will improve uniformity and high reliability [of] the silicon film” (page 49, Paper No. 20060621). The Applicant respectfully disagrees and traverses the assertions in the Official Action.

The melting-recrystallizing step in Hara is performed before the hydrogenating step. The melting-recrystallizing step and the hydrogenating step are not performed at the same time. Specifically, Hara appears to teach the following (see column 2, lines 25-36; and column 12, lines 20-46):

... In the annealing chamber C₃, a laser beam L is irradiated to an a-Si:H thin film 3 through a quartz window W and makes it change into a polycrystalline Si thin film 4 due to melting-recrystallization. Thereafter, without breaking the vacuum, the glass wafer 1 is transported to a hydrogenating chamber C₅. ...

Thus, even if one of ordinary skill in the art were motivated to combine Morosawa and Hara, the resulting alleged combination would not render obvious all the features of the present independent claims. Specifically, even if Morosawa's step of removing dangling bonds in poly-silicon thin film 6 by treating with ammonia and nitrogen plasma at 250 °C corresponds to a step of leveling a surface of a crystallized semiconductor film, as recited, for example in independent claim 47, and even if the Examiner's statement of motivation to combine Morosawa and Hara is sufficient and proper, the resulting alleged combination of Morosawa and Hara does not teach or suggest leveling a surface of a crystallized semiconductor film by recrystallizing the crystallized semiconductor film after removing a natural oxidation film. The alleged combination of Morosawa and Hara appears to merely teach leveling a surface of a crystallized semiconductor film after recrystallizing the semiconductor film.

Yamazaki '232 and Kudo do not cure the deficiencies in Morosawa and Hara. Yamazaki '232 is relied upon to allegedly teach furnace annealing in nitrogen and Kudo is relied upon to allegedly teach irradiation in air. However, Morosawa, Hara, Yamazaki '232 and Kudo, either alone or in combination, do not teach or suggest removing a natural oxidation or oxide film formed on a surface of a crystallized semiconductor film by etching after irradiation of a laser light; and leveling a surface of the crystallized semiconductor film by recrystallizing the crystallized semiconductor film after removing the natural oxidation or oxide film.

Independent claim 59 recites forming a gate insulating film over a crystallized semiconductor film after a leveling step; and forming an impurity region in the crystallized semiconductor film after forming the gate insulating film. The Official Action asserts that "Morosawa discloses ... forming an impurity [region] in the crystallized semiconductor film after [forming] the gate insulating film (i.e., during the S/D contact formation)" (page 44, Paper No. 20060621). The Applicant respectfully disagrees and traverses the assertions in the Official Action. Morosawa clearly discloses that "ions such as a phosphorous ion or a boron ion are implanted into the source/drain formation

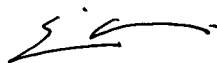
region 3a of the amorphous silicon thin film 3 using this photo resist film 4 as a mask to form an ion-implanted region 5" (paragraph [0008] of the English translation, submitted April 18, 2005). In Morosawa, these steps are performed before forming the gate insulating film 9. Therefore, Morosawa does not teach or suggest forming an impurity region in a crystallized semiconductor film after forming a gate insulating film.

Hara, Yamazaki '232 and Kudo do not cure the deficiencies in Morosawa. Hara is relied upon to allegedly teach recrystallization (as discussed above), Yamazaki '232 is relied upon to allegedly teach furnace annealing in nitrogen and Kudo is relied upon to allegedly teach irradiation in air. However, Morosawa, Hara, Yamazaki '232 and Kudo, either alone or in combination, do not teach or suggest forming an impurity region in a crystallized semiconductor film after forming a gate insulating film.

Since Morosawa and Hara do not teach or suggest all the claim limitations, a *prima facie* case of obviousness cannot be maintained. Accordingly, reconsideration and withdrawal of the rejections under 35 U.S.C. § 103(a) are in order and respectfully requested.

Should the Examiner believe that anything further would be desirable to place this application in better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,



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